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Epiphytic bryophytes of *Dicksonia antarctica* Labill. from selected pockets of Cool Temperate Rainforest, Central Highlands, Victoria

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Abstract
Epiphytie bryophytes of the Soft Tree-fern *Dicksonia antarctica* Labill. were examined in four Cool Temperate Rainforest pockets of the Central Highlands of Victoria. Thirty-two speeies, 17 mosses and 15 liverworts, were noted. There was no distinction in speeies assemblage between the north and south side of tree-ferns although bryophytes occurred on the south side of more tree-ferns than they did on the north side. (*The Victorian Naturalist* **123** (4), 2006, 229-235)

Introduction

Victorian Cool Temperate Rainforest is restricted to small pockets and ribbons found in gullies and along ridge tops (Howard and Ashton 1973; Busby 1986). These pockets are dominated by Myrtle Beech *Nothofagus cunninghamii* (Hook.) Oerst. with smaller trees such as Blackwood *Acacia melanoxylon* R.Br. and Southern Sassafras *Atherosperma moschatum* Labill. forming the understorey along with the Soft Tree-fern *Dicksonia antarctica* Labill. and Rough Tree-fern *Cyathea australis* (R.Br.) Domin. (Howard and Ashton 1973; Jarman and Brown 1983). The Soft Tree-fern (Fig. 1) is much more common than the Rough Tree-fern and frequently has a luxuriant cover of bryophytes (Cameron 1992; Jarman *et al.* 1986; Ough and Murphy 1996; Peacock 1994; Roberts *et al.* 2003), but only one published study has documented the bryophytes of tree-ferns. Roberts *et al.* (2003) listed 81 bryophytes on Soft Tree-ferns and fifty-two on Rough Tree-ferns in Tasmania.

This study examined the bryophytes of Soft Tree-ferns in selected Cool Temperate Rainforest pockets in Victoria.

Methods

Four pockets of Cool Temperate Rainforest from the Central Highlands of

Fig. 1. Soft Tree-ferns in Cool Temperate Rainforest are common, and potentially provide much surface area for epiphyte growth.

Victoria were examined between April and September in 1999. Three pockets (Lady Talbot Drive, Bellell Creek and Mount Donna Buang) were located within the Yarra Ranges National Park, while the fourth pocket (Mount Erica) was located in the Baw Baw National Park (Fig. 2). All sites were dominated by *N. cunninghamii;* however, Mountain Ash *Eucalyptus regnans* F Muell. was emergent in some areas. The understorey consisted of *A. melanoxylon,* Hazel Pomaderris *Pomaderris aspera* Sieb. ex DC, *A. moschatum* (Mt. Donna Buang only), *D. antarctica* and *C. australis*. The sparse ground cover was a combination of Hard Water-fern *Blechnum wattsii* Tindale and Mother Shield-fern *Polystichum proliferum* (R.Br.) Presl.

At each site, three transects were placed from the roadside edge of each pocket running the complete length of the pockets. Transects were not of equivalent length as pockets of Cool Temperate Rainforest in Victoria are small and of uneven shape. Quadrats of 10 m by 5 m were sampled at 15 m intervals along each transect. All Soft Tree-ferns that were 40 cm or more in circumference were sampled in each quadrat.

Quadrats of 20 cm by 20 cm were placed every 50 cm along transects running up the northern and southern aspect of each tree-fern up to a height of 2 m, this being the limit of accessibility. The old maxim that moss grows only on the south side of trees suggests that different species may occur on the two sides, albeit less on the north side, so both aspects were examined to ensure collection of as many species as possible. Percentage cover of each bryophyte was determined in each quadrat. All bryophytes were identified to species level. Mosses were identified using Scott and Stone (1976) and Beever *et al.* (1992), while liverworts were identified using Scott (1985). Revised taxonomic nomenclature followed that of Streimann and Klazenga (2002) for mosses and McCarthy (2003) for liverworts. Samples of each species are held by the Plant Ecological Research Unit at Deakin University, Burwood.

Non Metric Multidimensional Scaling (NMDS) was applied to the frequency data to determine species assemblage patterns at the various sites, with aspect and with height

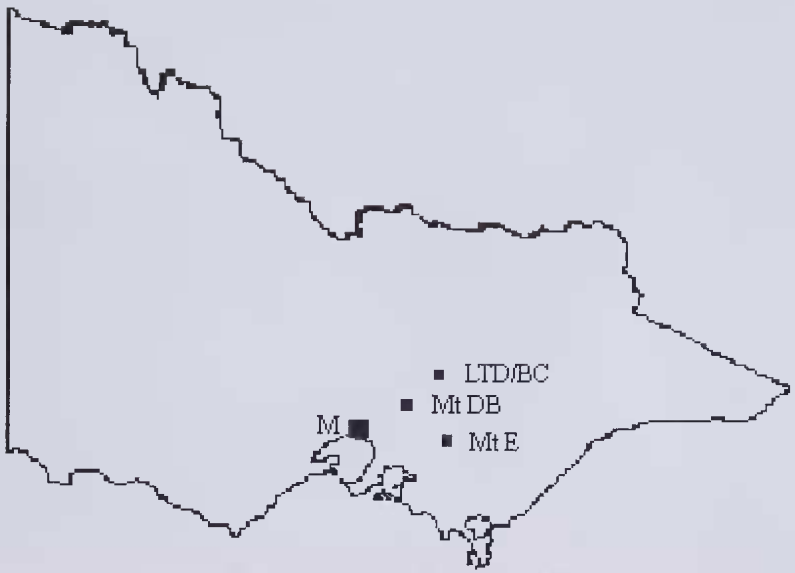

Fig. 2. Map showing general location of surveyed areas, relative to Melbourne (M). Lady Talbot Drive (LTD), Mount Donna Buang (Mt DB), Mount Erica (Mt E) and Bellell Creek (BC)

on the host. The software package PRIMER (Plymouth Routines in Multivariate Ecological Research) was used. This was based on a Bray-curtis similarity matrix.

Results

One hundred and seven Soft Tree-ferns were sampled, of which 83 had epiphytic bryophytes (Table 1). A total of 32 bryophyte species were recorded from the trunks of the tree-ferns (Table 1), of which seventeen were mosses, while 15 were liverworts (Table 2). Twenty-one species occurred at Mount Donna Buang, 20 at Lady Talbot Drive, 11 at Bellell Creek and nine at Mount Erica. No species occurred at all four sites although 10 species occurred at each of three sites. Thirteen species occurred at only one site: seven at Mount Donna Buang, three, two and one species at Lady Talbot Drive, Bellell Creek and Mount Erica respectively. Lady Talbot Drive and Mount Donna Buang had 29 of the total 32 bryophyte species between them but had only 12 species in common. NMDS showed they had two quite distinct assemblages of bryophytes (Fig. 3).

Bryophytes were found in only 214 of the total 982 quadrats examined on the trunks of the tree-ferns. Most abundant were the liverworts *Metzgeria furcata* (L) Dumort. and *Heteroscyphus fissistipus* (Hook.f. & Taylor) Schiffn. occurring in 46 and 39 quadrats respectively (Fig. 3). The most common moss was *Cyathophorum bulbosum* (Hedw.) Müll.Hal. which was found 33 times (Fig. 4). Only 10 species occurred 10 or more times. Fifteen species occurred less than five times.

Table 1. Distribution of bryophytes epiphytic on Soft Tree-ferns of the Central Highlands (LTB - Lady Talbot Drive, MDB – Mt Donna Buang, ME – Mt Erica, BC – Bellel Creek).

	LTB	MDB	ME	BC	Total
number of tree-ferns examined	65	24	7	11	107
number of tree-ferns with bryophytes	47	20	6	10	83
number of tree-ferns with bryophytes on south side	38	16	6	8	68
number of tree-ferns with bryophytes on north side	25	13	1	4	43
number of bryophyte species	20	21	9	11	32
number of bryophyte species on south side	16	18	7	9	28
number of bryophyte species on north side	14	13	4	6	24

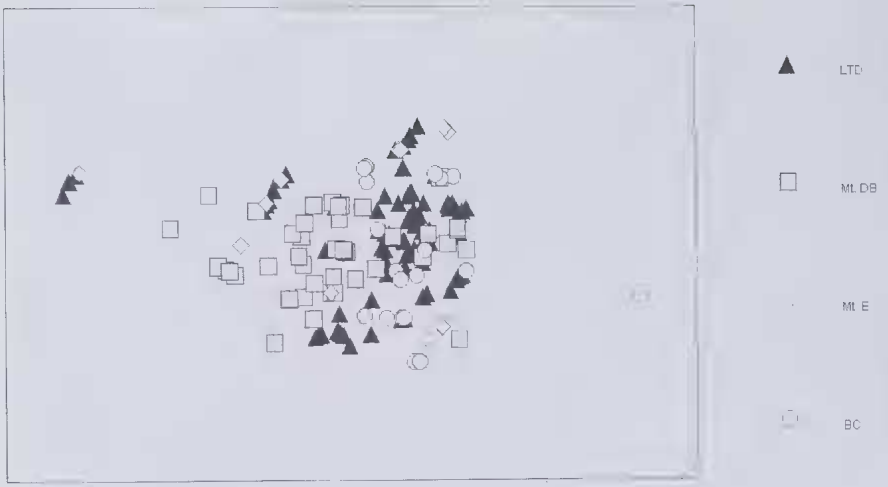

Fig. 3. NMDS showing distribution of epiphytic bryophytes. Lady Talbot Drive (LTD), Mount Donna Buang (Mt DB), Mount Erica (Mt E) and Bellell Creek (BC). Stress = 0.05

Bryophytes occurred on the south side of 68 tree-ferns but on the north side of only 43 tree-ferns. This pattern occurred at each site. At Lady Talbot Drive, 38 tree-ferns had bryophytes on the south side while only 25 tree-ferns had bryophytes on the north side, i.e. 80% compared to 53% of the total tree-ferns (with bryophytic epiphytes) respectively. Indeed, at each site, bryophytes occurred on the south side of 80% or more of the tree ferns with bryophytic epiphytes (Table 1). NMDS, however, showed no distinction between the two aspects.

Overall, there were slightly more species on the south side than north side of tree-ferns, i.e. 28 compared to 24 species respectively (Tables 1 and 2). This pattern was reflected at each site (Table 1). Seven species occurred only on the south side (*Thamnobryum pumilum, Catagonium nitens, Fissidens curvatus* var. *curvatus, Trachyloma planifolium, Distichophyllum crispulum, Kurzia hippurioides* and *Chiloscyphus semiteres* var. *semiteres*) while three species occurred only on the north side (*Plagiochila fasciculata, Tylimanthus tenellus* and *Dicranoloma billarderi*) (Table 2).

No distinction occurred between species distribution and their height on the trunk of tree-ferns.

Discussion

The much lower number of bryophytes found on Soft Tree-ferns in this study compared to the Tasmanian study (Roberts *et al.* 2003) is to be expected. Ten sites were examined in Tasmania while only four were investigated in this study. Also, Cool Temperate Rainforest in Tasmania is far more extensive, 563 000 hectares (Hickey *et al.* 1993), than in Victoria, 13 270 hectares (Adam 1992). Also, Victorian forests occur in small pockets or ribbons and thus are more prone to drying and fire than Tasmanian forests.

Old fronds of tree-ferns remain attached and form a skirt around the upper portion of trunks. This prevents light from penetrating this region of the trunk and protects this area of trunk from rain, forming a darker and drier region that would inhibit the colonisation of epiphytes. Short tree ferns, therefore, would have few if any bryophtes. Page and Brownsey (1986), Ough and Murphy (1996) and Ford and Gibson (2000) all reported few epiphytes on tree-ferns less than 2 m in height. This study included all tree-ferns of 40 cm or more in circumference but some were shorter than 2 m in height, contributing to some of the difference in bryophyte numbers of this study compared to the study of Roberts *et al.* (2003), where only tree-ferns

Table 2. Bryophytes of Soft Tree-ferns in Cool Temperate Rainforests of the Central Highlands. + indicates presence. Lady Talbot Drive (LTD), Bellell Creek (BC), Mount Donna Buang (MDB) and Mount Erica (ME).

Species	LTD	MDB	BC	MTE	N	S
Acrophyllum dentatum (Hook.f. & Wilson) Vitt & Crosby	+	+	+		+	+
Chiloscyphus muricatus (Lehm.) J.J.Engel & R.M.Schust.	+	+		+	+	+
Cyanolophocolea echinella (Lindenb. & Gottsche) R.M.Schust.	+	+			+	+
Cyathophorum bulbosum	+	+	+		+	+
Dicranoloma billarderi (Brid. ex Anon) Paris		+			+	+
Heteroscyphus coalitus (Hook.) Schiffn.	+				+	+
Heteroscyphus fissistipus (Hook.f. & Taylor) Schiffn.	+	+			+	+
Lepidozia ulothrix (Schwaegr.) Lindenb.	+	+	+		+	+
Leptophyllopsis laxus (Mitt.) R.M.Schust.	+					+
Leptostomum inclinans R.Br.	+			+	+	+
Leptotheca gaudichaudii Schwägr.	+	+	+		+	+
Metzgeria conjugata Lindb.	+	+			+	+
Metzgeria furcata (L.) Dumort.	+	+	+		+	+
Paracromastigum longiscyphum (Taylor) R.M.Schust. & J.J.Engel	+	+		+	+	+
Plagiothecium lamprostachys (Hampe) A.Jaeger	+		+		+	+
Rhaphidorrhynchium amoenum (Hedw.) M.Fleisch	+		+	+	+	+
Rhynchostegium tenuifolium (Hedw.) Reichardtvar. *tenuifolium*	+		+		+	+
Thamnobryum pumilum	+	+		+		+
Thuidiopsis sparsa (Hook.f. & Wilson) Broth.	+				+	+
Wijkia extenuata (Brid.) H.A.Crum	+	+		+	+	+
Catagonium nitens (Brid.) Cardot subsp. Nitens		+	+			+
Fissidens curvatus Hornsch var. *curvatus*			+			+
Trachyloma planifolium (Hedw.) Brid.			+			+
Bazzania involuta (Mont.) Trevis.		+			+	+
Dicranoloma dicarpum (Nees) Paris		+			+	+
Dicranoloma menziesii (Taylor) Renauld		+			+	+
Distichophyllum crispulum (Hook.f. & Wilson) Mitt.		+				+
Kurzia hippurioides (Hook.f. & Taylor) Grolle		+				+
Lepidozia laevifolia var. *laevifolia* (Hook.f. & Taylor) Taylor ex Gottsche, Lindenb. & Nees		+		+	+	+
Plagiochila fasciculata Lindenb.		+			+	
Tylimanthus tenellus (Hook.f. & Taylor) Mitt.		+			+	
Chiloscyphus semiteres var. *semiteres* (Lehm. & Lindenb.) Lehm. & Lindenb.				+		+

over 2 m in height were examined. It also explains why so few quadrats on the tree-fern trunks had bryophytes.

Roberts *et al.* (2003) concluded that Soft Tree-ferns were an important host for bryophytes in Tasmania. They found that the number of bryophyte species on tree-ferns were much higher than the number on *N. cunninghamii* found in similar forests, i.e. 81 compared to 55. In Victorian Cool Temperate Rainforest, Floyed (1999) found 46 bryophyte species on *N. cunninghamii*,

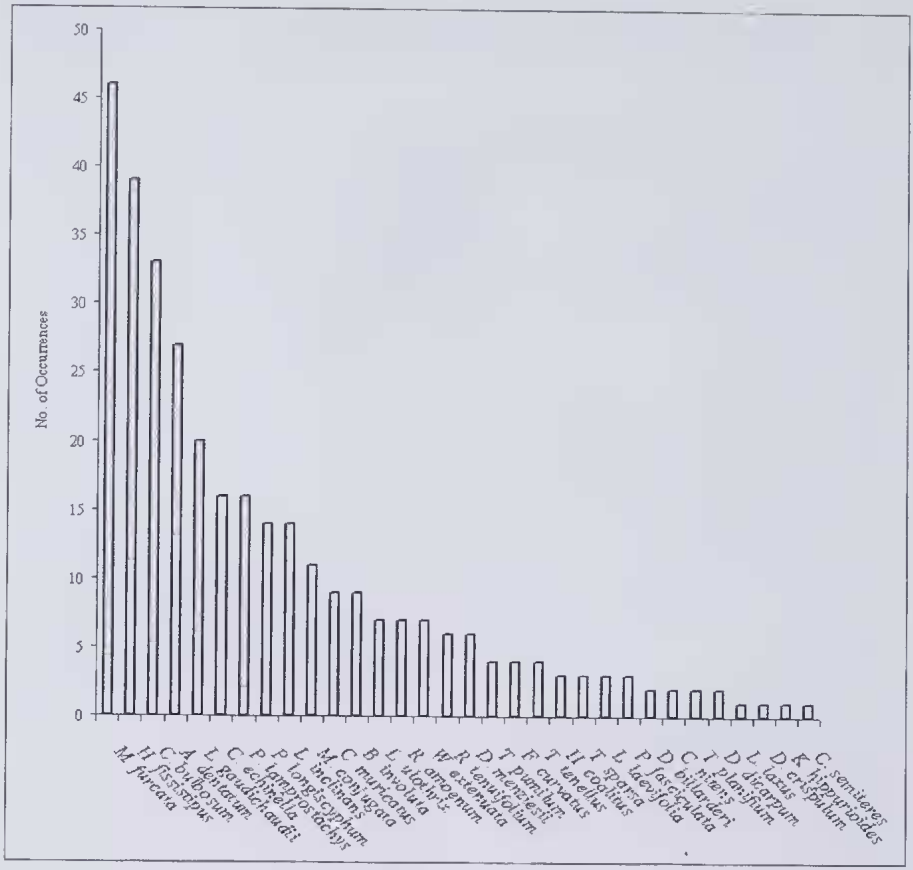

Fig. 4. The number of occurrences (quadrats) of bryophytes on Soft Tree-ferns of the Central Highlands.

43 on fallen logs, 33 on rock, 27 on *A. melanoxylon*, 25 on soil, 16 on *E. regnans*, eight on *A. moschatum* and only six on *Pomaderris aspera* Sieb. ex DC. Thus, Soft Tree-ferns in Victorian Cool Temperate Rainforest also are an important substratum type for bryophytes and their diversity, supporting 32 bryophyte species, but not as important as some other substrata. Also, the number of bryophyte species supported by a particular substratum can vary from place to place. In Victorian Cool Temperate Rainforest *N. cunninghamii* supports more bryophytes than Soft Tree-ferns, whereas the converse occurs in Tasmania.

A number of papers have shown that there are distinct differences in epiphyte species composition between aspects (Pike *et al.* 1975; Kantvilas and Minchin, 1989; Peck *et al.* 1995). Kantvilas and Minchin (1989) suggested differences in composition were caused by trunks leaning towards canopy gaps, resulting in the formation of a dry and wet side. They studied lichens but their findings are pertinent in that bryophytes tend to grow in more moist conditions than lichens, so it would be expected that more bryophytes would occur on the wet side regardless of whether it was the north or south aspect. This study did not examine moisture levels of the two aspects but shows that while there are more tree-ferns with bryophytes on the south side than on the north side, there is no distinction in species assemblage between the two aspects. Similarly, Franks and Bergstrom (2000) looked at the effects of aspect on

bryophytes growing on Antarctic Beech *Nothofagus moorei* (F Muell.) Krasser in south-east Queensland. They noted that although there were slightly fewer species of both mosses and liverworts on the southern aspect compared to the northern aspect of trees, there was no statistical difference.

Generally, Soft Tree-ferns make comparatively good hosts for bryophytes; however, their importance as a substratum can vary from place to place. In Tasmania, Soft Tree-ferns support more bryophytes than *N. cunninghamii* but this is not so in Victoria. This study also found quite a variation in the number of bryophytes supported by Soft Tree-ferns from place to place. This has important implications for conservation of bryophytes and the concept of vascular plants being useful as surrogates to determine which areas should be conserved to maintain bryophyte diversity. One host cannot be considered more important than another as the number of species supported by it can vary from place to place. Therefore the use of surrogacy must be used with caution when determining whether one area may be more important than another and so have conservation priority. In order to determine an area's importance for bryophyte conservation it is important to ascertain which bryophytes live there.

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